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ABSTRACT

This study was designed to determine the effect class size had on the reading achievement of first grade students. During a review of the literature, identified studies were analyzed for evidences of impact on student reading achievement, the instructional program, operational expenditures, and classroom space. The Virginia Beach research study was a modification of the South Carolina First Grade Pilot Project, 1975-76: The Effects of Class Size on Reading and Mathematics Achievement Study. A class of 29 pupils and a class of 21 students, referred to as the large ("normal" or control) or the small ("reduced" or experimental) class, constituted the treatment groups. The analysis was based upon the data elicited from eight pairs of schools. The reading achievement of first grade students in smaller classes, when compared to the reading achievement of first grade students in larger classes, was significantly higher. The project, which began September 1980, was designed to provide reliable data about program impact on which to make decisions of whether the model should be extended to other schools, modified and continued for purposes of further study, or terminated. (PN)

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VIRGINIA BEACH CITY PUBLIC SCHOOLS

Class Size Project
1980-1981

FINAL REPORT

DEPARTMENT OF INSTRUCTIONAL SERVICES
Research & Testing Services

Dr. E. E. Brickell
Division Superintendent

August 1981

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VIRGINIA BEACH CITY PUBLIC SCHOOLS

Class Size Project
1980-1981

FINAL REPORT

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CHAPTER 1

INTRODUCTION

Chapter 1

INTRODUCTION

The Virginia Beach City Public Schools Class Size Project was a research and development effort growing out of a directive by the School Board to determine the effects of class size on the reading achievement of pupils in the lower elementary grades. Specifically, the study was designed to determine the effect class size had on the reading achievement of first grade students.

The agreed to study began with the usual review of literature to identify operational and proposed class size studies. During the review process, identified studies were analyzed for evidences of impact on student reading achievement, the instructional program, operational expenditures, and classroom space.

The Ad Hoc Committee selected the South Carolina First Grade Pilot Project, 1975-76: The Effects of Class Size on Reading and Mathematics Achievement as the most appropriate study to replicate in order to determine the effects of class size on the reading achievement of Virginia Beach first graders. The Virginia Beach research study was a modification of the South Carolina study. A class of twenty-nine pupils, referred to as the large ("normal" or control) class, constituted one treatment group; and a class of twenty-one students, referred to as the small ("reduced" or experimental) class, constituted the other treatment group.

Originally, the analysis of data was to be based upon the random selection of ten treatment classes from the original twenty treatment classes, consisting of ten pairs of classes matched on racial and sexual composition of the student body, socioeconomic background of the students, and school curriculum; however, because two schools were withdrawn from the study, the analysis was based upon the data elicited from the eight remaining schools (eight pairs).

The Virginia Beach City Public Schools Class Size Project, which began September 1980, was designed to provide reliable data about program impact. Systematic implementation and evaluation of the class size program in the pilot schools were to provide reliable data on which to make decisions of whether the model should be extended to other schools, modified and continued for purposes of further study, or terminated.

Virginia Beach City Public Schools
Task Identification and Schedule
for
Implementation of Class Size Project

ACTIVITIES	EXPLANATION	START	FINISH
Appointment of Ad Hoc Committee	Division Superintendent appointed a committee of research specialists to determine the effects of class size on reading achievemert in the lower elementary grades.	April 25, 1980	May 7, 1980
Joint meeting of School Board and Ad Hoc Committee	School Board members presented suggested approaches which the study would take.		May 16, 1980
Research Design	Ad Hoc Committee submitted research and evaluation design for class size project to School Board.	June 13, 1980	June 17, 1980
Selection of Testing Instruments	The Ad Hoc Committee selected an instrument to pretest and posttest the reading achievement of the students.	June 4, 1980	July 7, 1980
Selection of Project Schools	Ad Hoc Committee selected ten project schools.	June 7, 1980	July 11, 1980
Selection of Project Teachers	Ad Hoc Committee randomly selected two teachers to participate; one served as experimental group teacher and the other as the control group teacher.	July 8, 1980	July 18, 1980
Selection of Project First Graders	Ad Hoc Committee selected first grade students to participate in study.	July 18, 1980	August 27, 1980
Briefing of Project Teachers	Ad Hoc Committee and principals briefed project teachers on program, problems, and responsibility.	August 25, 1980	August 29, 1980

ACTIVITIES	EXPLANATION	START	FINISH
Pretest of Project First Graders	Ad Hoc Committee and teachers administered pretest instrument to measure reading achievement of the project first graders.	September 2, 1980	September 30, 1980
Posttest of Project First Graders	Ad Hoc Committee and teachers administered posttest instrument to measure reading achievement of the project first graders.	May 26, 1981	May 29, 1981
Scoring of Pretest and Posttest	The pretest and posttest instruments were scored by the testing agency.	June 1, 1981	August 17, 1981
Analysis of Data	Ad Hoc Committee analyzed all research data.	August 18, 1981	August 31, 1981
Final Report	Ad Hoc Committee submitted final report to School Board.	September 1, 1981	September 15, 1981
Study Direction	School Board determined whether to extend project to other schools, modify and continue for purposes of further study, or terminate.	September 16, 1981	

CHAPTER 2

THE PROBLEM AND APPROACH

Chapter 2

THE PROBLEM AND APPROACH

Researchers have long concerned themselves with the effect of class size on pupil achievement. Educators and lay persons have debated the possible impact of reductions in class size. Increased learning which might result from more individualized instruction has been an area of considerable contention. Investigators have designed and executed a considerable number and a wide variety of studies to arrive at some definitive conclusion about how pupil achievement is affected by smaller classes. There is little agreement among the investigators about what the actual effects are. When one reviews previous studies, one recognizes that it is difficult, if not impossible, to design a study which will produce results that can be generalized to every population and circumstance. Because data from previous class size studies can not be generalized, it is reasonable that one consider each study in terms of a specific population, design, and intent.

Even though there is no body of class size research which can be generalized to the Virginia Beach City Public Schools population and circumstances, there is a recognition by some administrators, teachers, and lay persons that the common sense expectancy for reduction in class size is that the teacher will have more time to spend with each child and increased learning will result. In practice, the common sense expectancy is not supported by any hard data and decisions relative to class size are based, therefore, on state and regional accrediting agency standards and available resources. It is reasonable that an effort be made to

generate hard data for future decision making relative to class size. To that end, the only apparent approach to the generating of such data was to design and conduct a study of the effect of class size on the learning of Virginia Beach students.

Statement of the Problem

The Virginia Beach Class Size Project was designed for the specific purpose of determining the effect of class size on the reading achievement of first grade students in selected Virginia Beach elementary schools.

Delimitations

For the purpose of the Virginia Beach Class Size Project, the following delimitations were noted:

1. Because the study was limited to one school year, longitudinal effects on subject groups could not be determined.
2. The study was limited to the non-Title I elementary schools for Virginia Beach, Virginia.
3. The elementary schools chosen for the study had a first grade enrollment of at least fifty first grade students.
4. The elementary schools practiced heterogeneous assignments to homerooms.
5. The elementary schools did not practice regrouping for reading instruction at the first grade level.
6. It was recognized that reliability of norm referenced test results of beginning first grade students is subject to question.
7. The area selected for study was limited to student reading achievement as measured by the California Achievement Tests.

8. The research design did not control or consider the effect on data reliability of the large number of student subjects who left the school division during the study.

Assumptions

For the purpose of the Virginia Beach Class Size Project, the following assumptions were generated:

1. Smaller class loads would permit teachers additional time for individualized instruction.

2. Teachers would utilize additional time for individualized instruction.

3. Individualizing instruction would improve reading achievement of first grade students.

4. Reading technique, program, and materials were similar from school to school and from class to class.

5. Teachers were comparable in professional training, expertise, and competence.

Hypothesis

The Virginia Beach Class Size Project was designed to test the null hypothesis which holds that no significant difference exists in the reading achievement of first grade students in small classes and first grade students in large classes.

ADMINISTRATION AND PROCEDURES OF THE STUDY

The Virginia Beach Class Size Project was undertaken at the direction of the School Board to investigate at the local level the effects of class size on student learning. The Division Superintendent appointed an Ad Hoc Class Size Committee for the purpose of designing and conducting the investigation. The design of the Virginia Beach Class Size Project

was reviewed and approved by representatives of the School Board. The Ad Hoc Committee was charged with conducting the study, analyzing the data, and presenting a documented report to the Board.

Project Sample Description

The Virginia Beach City Public Schools Class Size Project sample initially consisted of ten project schools and twenty project classes, with the student sample consisting of five hundred students. Table 1 reveals the number of first grade students in each of the project classes within each of the ten school pairs. The class size of the large or control classes was twenty-nine students, and the class size of the small or experimental classes was twenty-one students. The class size difference was eight students.

Selection of Project Student Population

The first grade population which participated in the study was chosen and assigned from selected elementary schools which met participation criteria as defined by the Ad Hoc Committee and approved by Board representatives. Pupils who participated in this study were selected and assigned at random to treatment groups. For purposes of the investigation, representatives of the Board arbitrarily defined small (experimental) and large (control) groups.

Designation of Project Schools

Elementary schools selected to participate in this study met the following three criteria:

1. Each school had a first grade enrollment of at least fifty first grade students.

Table 1

Difference Between the Control Class Size (C) and the Experimental Class Size (E) for Each of the Ten Pairs of Project Classes September 1980 - June 1981

Schools	Control Class Size (C) Enrollment Sept. '80	Control Class Size (C) Enrollment June '81	Experimental Class Size (E) Enrollment Sept. '80	Experimental Class Size (E) Enrollment June '81	Difference (C - E) Sept. '80	Difference (C - E) June '81
Arrowhead	29	27	21	21	8	6
Brookwood	29	29	21	21	8	8
College Park	29	28	21	20	8	8
Indian Lakes	29	28	21	21	8	7
Kempsville	29	28	21	21	8	7
Malibu*	29	--	21	--	8	-
Plaza	29	26	21	18	8	8
Thalia*	29	--	21	--	8	-
Trantwood	29	29	21	21	8	8
Windsor Woods	29	29	21	20	8	9
Mean	29	28	21	20	8	8

*These two schools were withdrawn from the study because school enrollment increased above the maximum allowable levels.

2. The school practiced heterogeneous assignments to homerooms and did not regroup for purposes of reading instruction.

3. The school was not a Title I school.

Because of project design and practical limitations, elementary schools were selected for the study on a non-random basis. The class size Ad Hoc Committee selected elementary schools which had pupil populations typical of the majority of the elementary schools in the division. Of the ten schools which were originally assigned to the project, two schools were withdrawn from the study, leaving eight schools to be included in the final report of the project.

Selection of Project Teachers

The Ad Hoc Committee randomly selected one control class teacher and one experimental class teacher from among all first grade teachers who had been assigned to the staff for each elementary school involved in the study.

Collection of Data

Data were collected for six variables: one independent variable - class size, one dependent variable - posttest reading achievement, one classification variable - school, one covariate - prior reading achievement, two extraneous variables - students race and student sex.

After both the pretest and posttest administrations, all project test booklets were returned to the Office of Research and Testing. Trained staff members checked the coded information and edited the test booklets. Whenever possible, data coded incorrectly on the test booklets were corrected.

Student responses marked in the test booklets were reviewed for extraneous marks, multiple gridding, and patterned responses. Those booklets that did not meet the Ad Hoc Committee's standards were eliminated from the analysis. Since the variable data were coded on the pretest booklets, staff members coded all variable data on the posttest materials in order to ensure consistency and accuracy in coding.

Analysis for Interaction

Data were analyzed to determine interactions between reading achievement and two intervening or extraneous variables:

1. Two levels of the student race variables were examined: white and nonwhite.
2. Two levels of the student sex variables were examined: boy and girl.

Evaluation Questions

1. What impact did the Virginia Beach City Public Schools Class Size Project have upon student reading achievement in the target schools?
2. What are the specific skill areas in which students exhibited an increase in knowledge?

The measurement procedures previously listed above will be further discussed in Table 2, Measurement Planning Matrix, and Table 3, Logistical Plan, that follow.

ORGANIZATION OF THE STUDY

The introduction, task identification, and schedule for the implementation of the class size project are described in Chapter 1.

The problem and approach, statement of problem, delimitations, assumptions, hypothesis, administration and procedures of the study,

Table 2

MEASUREMENT PLANNING MATRIX

Measurement Procedure	Evaluation Questions	
	1	2
Pretest and Posttest of student reading achievement	-determine the overall knowledge gained	-determine specific skill areas in which students exhibit an increase in knowledge

Table 3

LOGISTICAL PLAN

Measurement Procedure	Type of Instrument Needed	Administrator	Administered	Sample	Data Analysis	Information Available	Evaluation Questions Addressed
A. Pretest of Student Reading Achievement	California Achievement Test, Form C	Ad Hoc Committee	September 2 - 30, 1980	500 first graders	Descriptive Analysis	November 1980	#1 and #2
B. Posttest of Student Reading Achievement	California Achievement Test, Form C	Ad Hoc Committee	May 26 - 29, 1981	500 first graders	Descriptive Analysis	August 1981	#1 and #2

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project sample description, selection of project student population, designation of project schools, selection of project teachers, collection of data, analysis for interaction, and the organization of the study are presented in Chapter 2.

Student reading achievement, the measuring instrument, sources and collection of data, and analyses are presented in Chapter 3.

A summary of the research and conclusions based upon the findings are presented in Chapter 4.

PILOT SCHOOLS

Virginia Beach City Public Schools
Class Size Project
1980-1981

1. Arrowhead Elementary
2. Brookwood Elementary
3. College Park Elementary
4. Indian Lakes Elementary
5. Kempsville Elementary
6. Malibu Elementary*
7. Plaza Elementary
8. Thalia Elementary*
9. Trantwood Elementary
10. Windsor Woods Elementary

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*These two schools were withdrawn from the study because school enrollment increased above the maximum allowable levels.

CHAPTER 3

STUDENT READING ACHIEVEMENT

Chapter 3

STUDENT READING ACHIEVEMENT

The purpose of this chapter is to compare reading achievement test raw scores of first grade students who participated in the experimental classes (small classes, maximum of twenty-one students per class), with the reading achievement test raw scores of first grade students who participated in the control class (large classes, maximum of twenty-nine students per class). As shown in Table 4, four hundred ninety-six first grade students, two hundred nine in the experimental group and two hundred eighty-seven in the control, started the class size project by taking the reading achievement pretest during September 1980, while three hundred eighty-seven, one hundred sixty-three in the experimental group and two hundred twenty-four in the control group, completed the project by taking the posttest during May 1981. Because of student migration, usable reading achievement test raw scores could be obtained only for the three hundred thirty-five students, one hundred forty-one experimental and one hundred ninety-four control students, who took both the pretest and the posttest.

California Achievement Test

To obtain the reading achievement test raw scores, students were administered a pre/posttest edition of the California Achievement Tests, Level 11C (CAT). The basic purpose of the CAT, an innovative battery of achievement tests, is to measure knowledge and understanding in reading, mathematics, language, spelling, and reference skills. For

Table 4

First Grade Students Who Took the Reading Achievement Tests

School	Group	Pretest Number	Posttest Number	Pretest & Posttest Number
Arrowhead	Experimental	21	21	16
	Control	29	27	26
	Total	50	48	42
Brookwood	Experimental	21	21	21
	Control	29	29	23
	Total	50	50	44
College Park	Experimental	21	20	17
	Control	28	28	21
	Total	49	48	38
Indian Lakes	Experimental	21	21	20
	Control	28	28	27
	Total	49	49	47
Kempsville	Experimental	21	21	20
	Control	29	28	26
	Total	50	49	46
Malibu*	Experimental	21	--	--
	Control	29	--	--
	Total	50	--	--
Plaza	Experimental	21	18	16
	Control	29	26	19
	Total	50	44	35
Thalia*	Experimental	20	--	--
	Control	29	--	--
	Total	49	--	--
Trantwood	Experimental	21	21	16
	Control	29	29	24
	Total	50	50	40
Windsor Woods	Experimental	21	20	15
	Control	28	29	28
	Total	49	49	43
TOTAL	Experimental	209	163	141
	Control	287	224	194
GRAND TOTAL		496	387	335

*These two schools were withdrawn from the study because school enrollment increased above the maximum allowable levels.

this study, only the reading achievement battery was administered. Reading achievement test results were compared for the total reading test. The reading subtests were not compared individually because of the low test-retest reliability.

FIRST GRADE STUDENTS

The data in Tables 5 and 6 present the achievement test raw scores of all first grade students who supplied usable data for the class size project as measured by the California Achievement Test (Reading). As previously shown in Table 4, the experimental group was represented by one hundred forty-one students, while the control group was represented by one hundred ninety-four students. In this section, the major step of presenting and comparing the test scores is undertaken.

The data in Table 5 are the mean and gain raw scores for the first graders on the total reading California Achievement Test. An analysis of covariance (ANOCOVA) was employed on the pre/posttest in order to determine whether or not there was a statistically significant difference ($p < .05$) between the two reference groups (experimental group versus control group). In this case, prior "total reading" achievement as measured by the pretest was used to adjust for initial differences in the achievement test raw scores of the experimental and control groups of first graders. As shown in Table 6, after the ANOCOVA procedure adjusted for the statistically significant difference ($p < .05$) for the covariate (pretest), a statistically significant difference was observed for the main effect (difference between groups). Therefore, the statistically significant difference found for the posttest indicates that the achievement of the experimental group

Table 5

Mean and Gain Raw Scores for the First Grade Students
on the
California Achievement Test: Total Reading

School	Group	Pretest Mean	Posttest Mean	Gain Score
Arrowhead	Experimental	18.7500	42.9375	+24.1875
	Control	22.8077	42.9615	+20.1538
	Total	21.2619	42.9524	+21.6905
Brookwood	Experimental	23.8095	54.8095	+31.0000
	Control	21.2727	49.8182	+28.5455
	Total	22.5116	52.2558	+29.7442
College Park	Experimental	23.5294	50.1176	+26.5882
	Control	25.3333	47.1905	+21.8572
	Total	24.5263	48.5000	+23.9737
Indian Lakes	Experimental	25.5000	53.3500	+27.8500
	Control	23.7778	45.0741	+21.2963
	Total	24.5106	48.5957	+24.0851
Kempsville	Experimental	26.6500	52.9500	+26.3000
	Control	22.4375	49.3125	+26.8750
	Total	24.7778	51.3333	+26.5555
Plaza	Experimental	22.8571	50.2857	+27.4286
	Control	16.7368	45.6316	+28.8948
	Total	19.3333	47.6061	+28.2728
Trantwood	Experimental	26.6250	49.0000	+22.3750
	Control	18.2500	49.0833	+30.8333
	Total	21.6000	49.0500	+27.4500
Windsor Woods	Experimental	21.8667	47.0667	+25.2000
	Control	22.2857	43.2500	+20.9643
	Total	22.1395	44.5814	+22.4419
TOTAL	Experimental	23.8631	50.4317	+26.5684
	Control	21.7152	46.2623	+24.5465
GRAND TOTAL		22.6429	48.0621	+25.4192

Table 6

Analysis of Covariance for First Grade Students
on the
California Achievement Test: Total Reading

Source of Variation	Sum of Squares	df	Mean Square	F	Significance of F
Covariate (Pretest)	7,233.273	1	7,233.273	98.252	0.000*
Main Effects (Group)	706.316	1	706.316	9.594	0.002*
Residual	23,484.652	319	73.620		
Total	31,424.242	321	97.895		

*Significant at $p < .05$

(small classes) was greater than the achievement of the control group (large classes) as measured by the total reading California Achievement Test.

MALE FIRST GRADE STUDENTS

The data in Table 7 through 9 represent the achievement test raw scores of all male first grade students who supplied usable data for the class size project as measured by the California Achievement Test (Reading). As given in Table 7, the experimental group was represented by seventy-one male students, while the control group was represented by ninety-nine male students. In this section, the major step of presenting and comparing the test scores is undertaken.

The data in Table 8 are the mean and gain raw scores for the male first graders on the total reading California Achievement Test. An analysis of covariance (ANOCOVA) was employed on the pre/posttest in order to determine whether or not there was a statistically significant difference ($p < .05$) between the two reference groups (experimental group versus control group). In this case, prior "total reading" achievement as measured by the pretest was used to adjust for initial differences in the achievement test raw scores of the experimental and control groups of male first graders. As shown in Table 9, after the ANOCOVA procedure adjusted for the statistically significant difference ($p < .05$) for the covariate (pretest), a statistically significant difference was observed for the main effect (difference between groups). Therefore, the statistically significant difference found for the posttest

Table 7

Male First Grade Students Who Took Both
Pretest and Posttest Reading Achievement Tests

School	Group	Number
Arrowhead	Experimental	6
	Control	15
	Total	21
Brookwood	Experimental	11
	Control	13
	Total	24
College Park	Experimental	9
	Control	9
	Total	18
Indian Lakes	Experimental	8
	Control	11
	Total	19
Kempsville	Experimental	13
	Control	12
	Total	25
Plaza	Experimental	8
	Control	11
	Total	19
Trantwood	Experimental	9
	Control	13
	Total	22
Windsor Woods	Experimental	7
	Control	15
	Total	22
TOTAL	Experimental	71
	Control	99
GRAND TOTAL		170

Table 8

Mean and Gain Raw Scores for Male First Grade Students
on the
California Achievement Test: Total Reading

School	Group	Pretest Mean	Posttest Mean	Gain Score
Arrowhead	Experimental	18.3333	41.5000	+23.1667
	Control	22.8667	42.5333	+19.6666
	Total	21.5714	42.2381	+20.6667
Brookwood	Experimental	24.0000	54.9091	+30.9091
	Control	22.1667	48.9167	+26.7500
	Total	23.0435	51.7826	+28.7391
College Park	Experimental	20.8889	46.1111	+25.2222
	Control	26.1111	49.0000	+22.8889
	Total	23.5000	47.5556	+24.0556
Indian Lakes	Experimental	25.5000	54.2500	+28.7500
	Control	24.5455	44.1818	+19.6363
	Total	24.9474	48.4211	+23.4737
Kempsville	Experimental	27.0000	52.9231	+25.9231
	Control	23.8889	49.7778	+25.8889
	Total	25.7273	51.6364	+25.9091
Plaza	Experimental	19.4286	46.5714	+27.1428
	Control	18.0000	43.8182	+25.8182
	Total	18.5556	44.8889	+26.3333
Trantwood	Experimental	26.0000	48.0000	+22.0000
	Control	20.0769	51.4615	+31.3846
	Total	22.5000	50.0455	+27.5455
Windsor Woods	Experimental	20.8571	47.0000	+26.1429
	Control	21.4667	39.7333	+18.2666
	Total	21.2727	42.0455	+20.7728
TOTAL	Experimental	23.3286	49.6714	+26.3428
	Control	22.2105	45.7579	+23.5474
GRAND TOTAL		22.6848	47.4182	+24.7334

Table 9

Analysis of Covariance for Male First Grade Students
on the
California Achievement Test: Total Reading

Source of Variation	Sum of Squares	df	Mean Square	F	Significance of F
Covariate (Pretest)	4,369.613	1	4,369.613	58.142	0.000*
Main Effects (Group)	427.297	1	427.297	5.686	0.018*
Residual	12,174.984	162	75.154		
Total	16,971.895	164	103.487		

*Significant at $p < .05$

indicates that the achievement of the experimental group (small classes) of male first graders was greater than the achievement of the control group (large classes) of male first graders as measured by the total reading California Achievement Test.

FEMALE FIRST GRADE STUDENTS

The data in Tables 10 through 12 represent the achievement test raw scores of all female first grade students who supplied usable data for the class size project as measured by the California Achievement Test (Reading). As presented in Table 10, the experimental group was represented by seventy female students, while the control group was represented by ninety-five female students. In this section, the major step of presenting and comparing the test scores is undertaken.

The data in Table 11 are the mean and gain raw scores for the female first graders on the total reading California Achievement Test. An analysis of covariance (ANOCOVA) was employed on the pre/posttest in order to determine whether or not there was a statistically significant difference ($p < .05$) between the two reference groups (experimental group versus control group). In this case, prior "total reading" achievement as measured by the pretest was used to adjust for initial differences in the achievement test raw scores of the experimental and control groups of female first graders. As shown in Table 12, after the ANOCOVA procedure adjusted for the statistically significant difference ($p < .05$) for the covariate (pretest), a statistically significant difference was observed for the main effect (difference between groups). Therefore, the statistically significant difference found for the posttest indicates

Table 10

Female First Grade Students Who Took Both
Pretest and Posttest Reading Achievement Tests

School	Group	Number
Arrowhead	Experimental	10
	Control	11
	Total	21
Brookwood	Experimental	10
	Control	10
	Total	20
College Park	Experimental	8
	Control	12
	Total	20
Indian Lakes	Experimental	12
	Control	16
	Total	28
Kempsville	Experimental	7
	Control	14
	Total	21
Plaza	Experimental	8
	Control	8
	Total	16
Trantwood	Experimental	7
	Control	11
	Total	18
Windsor Woods	Experimental	8
	Control	13
	Total	21
TOTAL	Experimental	70
	Control	95
GRAND TOTAL		165

Table 11

Mean and Gain Raw Scores for Female First Grade Students
on the
California Achievement Test: Total Reading

School	Group	Pretest Mean	Posttest Mean	Gain Score
Arrowhead	Experimental	19.0000	43.8000	+24.8000
	Control	22.7273	43.5455	+20.8182
	Total	20.9524	43.6667	+22.7143
Brookwood	Experimental	23.6000	54.7000	+31.1000
	Control	20.2000	50.9000	+30.7000
	Total	21.9000	52.8000	+30.9000
College Park	Experimental	26.5000	54.6250	+28.1250
	Control	24.7500	45.8333	+21.0833
	Total	25.4500	49.3500	+23.9000
Indian Lakes	Experimental	25.5000	52.7500	+27.2500
	Control	23.2500	45.6875	+22.4375
	Total	24.2143	48.7143	+24.5000
Kempsville	Experimental	26.0000	53.0000	+27.0000
	Control	20.5714	48.7143	+28.1429
	Total	23.2857	50.8571	+27.5714
Plaza	Experimental	26.2857	54.0000	+27.7143
	Control	15.0000	48.1250	+33.1250
	Total	20.2667	50.8667	+30.6000
Trantwood	Experimental	27.4286	50.2857	+22.8571
	Control	16.0909	46.2727	+30.1818
	Total	20.5000	47.8333	+27.3333
Windsor Woods	Experimental	22.7500	47.1250	+24.3750
	Control	23.2308	47.3077	+24.0769
	Total	23.0476	47.2381	+24.1905
TOTAL	Experimental	24.4058	51.2029	+26.7971
	Control	21.1818	46.8068	+25.6250
GRAND TOTAL		22.5987	48.7389	+26.1402

Table 12

Analysis of Covariance for Female First Grade Students
on the
California Achievement Test: Total Reading

Source of Variation	Sum of Squares	df	Mean Square	F	Significance of F
Covariate (Pretest)	2,904.124	1	2,904.124	40.248	0.000*
Main Effects (Group)	295.979	1	295.979	4.102	0.045*
Residual	11,111.953	154	72.156		
Total	14,312.059	156	91.744		

*Significant at $p < .05$

that the achievement of the experimental group (small classes) of female first graders was greater than the achievement of the control group (large classes) of female first graders as measured by the total reading California Achievement Test.

WHITE FIRST GRADE STUDENTS

The data in Tables 13 through 15 represent the achievement test raw scores of all white first grade students who supplied usable data for the class size project as measured by the California Achievement Test (Reading). As presented in Table 13, the experimental group was represented by one hundred thirty white students, while the control group was represented by one hundred seventy-three white students. In this section, the major step of presenting and comparing the test scores is undertaken.

The data in Table 14 are the mean and gain raw scores for the white first graders on the total reading California Achievement Test. An analysis of covariance (ANOCOVA) was employed on the pre/posttest in order to determine whether or not there was a statistically significant difference ($p < .05$) between the two reference groups (experimental group versus control group). In this case, prior "total reading" achievement as measured by the pretest was used to adjust for initial differences in the achievement test raw scores of the experimental and control groups of white first graders. As shown in Table 15, after the ANOCOVA procedure adjusted for the statistically significant difference ($p < .05$) for the covariate (pretest), a statistically significant difference was observed for the main effect (difference between groups). Therefore, the statistically significant difference found for the posttest indicates

Table 13

White First Grade Students Who Took Both
Pretest and Posttest Reading Achievement Tests

School	Group	Number
Arrowhead	Experimental	15
	Control	24
	Total	39
Brookwood	Experimental	20
	Control	20
	Total	40
College Park	Experimental	14
	Control	17
	Total	31
Indian Lakes	Experimental	18
	Control	24
	Total	42
Kempsville	Experimental	19
	Control	25
	Total	44
Plaza	Experimental	15
	Control	17
	Total	32
Trantwood	Experimental	14
	Control	20
	Total	34
Windsor Woods	Experimental	15
	Control	26
	Total	41
TOTAL	Experimental	130
	Control	173
GRAND TOTAL		303

Table 14

Mean and Gain Raw Scores for White First Grade Students on the California Achievement Test: Total Reading

School	Group	Pretest Mean	Posttest Mean	Gain Score
Arrowhead	Experimental	18.6000	42.3333	+23.7333
	Control	23.0833	43.0000	+19.9167
	Total	21.3590	42.7436	+21.3846
Brookwood	Experimental	22.9500	54.6500	+31.7000
	Control	20.5263	48.9474	+28.4211
	Total	21.7692	51.8718	+30.1026
College Park	Experimental	23.7143	50.4286	+26.7143
	Control	26.5882	48.5882	+22.0000
	Total	25.2903	49.4194	+24.1291
Indian Lakes	Experimental	26.1667	54.1111	+27.9444
	Control	24.0833	46.2500	+22.1667
	Total	24.9762	49.6190	+24.6428
Kempsville	Experimental	26.8421	50.8462	+24.0041
	Control	22.4375	49.3125	+26.8750
	Total	24.8286	51.1429	+26.3204
Plaza	Experimental	23.3077	50.8462	+27.5385
	Control	16.7059	46.3529	+29.6470
	Total	19.5667	48.3000	+28.7333
Trantwood	Experimental	26.9286	49.6429	+22.7143
	Control	18.9500	49.6500	+30.7000
	Total	22.2353	49.6471	+27.4118
Windsor Woods	Experimental	21.8667	47.0667	+25.2000
	Control	22.5385	42.6923	+20.1538
	Total	22.2927	44.2927	+22.0000
TOTAL	Experimental	23.8984	50.5547	+26.6563
	Control	21.9755	46.4908	+24.5153
GRAND TOTAL		22.8213	48.2784	+25.4571

Table 15

Analysis of Covariance for White First Grade Students on the California Achievement Test: Total Reading

Source of Variation	Sum of Squares	df	Mean Square	F	Significance of F
Covariate (Pretest)	6,448.949	1	6,448.949	88.618	0.000*
Main Effects (Group)	658.426	1	658.427	9.048	0.003*
Residual	20,958.566	288	72.773		
Total	28,065.941	290	96.779		

*Significant at $p < .05$

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that the achievement of the experimental group (small classes) of white first graders was greater than the achievement of the control group (large classes) of white first graders as measured by the total reading California Achievement Test.

NONWHITE FIRST GRADE STUDENTS

The data in Tables 16 through 18 represent the achievement test raw scores of all nonwhite first grade students who supplied usable data for the class size project as measured by the California Achievement Test (Reading). As depicted in Table 16, the experimental group was represented by eleven nonwhite students, while the control group was represented by twenty-one nonwhite students. In this section, the major step of presenting and comparing the test scores is undertaken. (NOTE: Because the analysis was based upon such a small sample, extreme caution should be emphasized in generalizing the findings to the total nonwhite first grade student population.)

The data in Table 17 are the mean and gain raw scores for the nonwhite first graders on the total reading California Achievement Test. An analysis of covariance (ANOCOVA) was employed on the pre/posttest in order to determine whether or not there was a statistically significant difference ($p < .05$) between the two reference groups (experimental group versus control group). In this instance, prior "total reading" achievement as measured by the pretest was used to adjust for initial differences in the achievement test raw scores of the experimental and control groups of nonwhite first graders. As shown in Table 18, after the ANOCOVA procedure adjusted for the statistically significant difference ($p < .05$)

Table 16

Nonwhite First Grade Students Taking Both
Pretest and Posttest Reading Achievement Tests

School	Group	Number
Arrowhead	Experimental	1
	Control	2
	Total	3
Brookwood	Experimental	1
	Control	3
	Total	4
College Park	Experimental	3
	Control	4
	Total	7
Indian Lakes	Experimental	2
	Control	3
	Total	5
Kempsville	Experimental	1
	Control	1
	Total	2
Plaza	Experimental	1
	Control	2
	Total	3
Trantwood	Experimental	2
	Control	4
	Total	6
Windsor Woods	Experimental	--
	Control	2
	Total	2
TOTAL	Experimental	11
	Control	21
GRAND TOTAL		32

Table 17

Mean and Gain Raw Scores for Nonwhite First Grade Students on the California Achievement Test: Total Reading

School	Group	Pretest Mean	Posttest Mean	Gain Score
Arrowhead	Experimental	21.0000	52.0000	+31.0000
	Control	19.5000	42.5000	+23.0000
	Total	20.0000	45.6667	+25.6667
Brookwood	Experimental	41.0000	58.0000	+17.0000
	Control	26.0000	55.3333	+29.3333
	Total	29.7500	56.0000	+26.2500
College Park	Experimental	22.6667	48.6667	+26.0000
	Control	20.0000	41.2500	+21.2500
	Total	21.1429	44.4286	+23.2857
Indian Lakes	Experimental	19.5000	46.5000	+27.0000
	Control	21.3333	35.6667	+14.3334
	Total	20.6000	40.0000	+19.4000
Kempsville	Experimental	23.0000	58.0000	+35.0000
	Control	-------	-------	-------
	Total	23.0000	58.0000	+35.0000
Plaza	Experimental	17.0000	43.0000	+26.0000
	Control	17.0000	39.5000	+22.5000
	Total	17.0000	40.6667	+23.6667
Trantwood	Experimental	24.5000	44.5000	+20.0000
	Control	14.7500	46.2500	+31.5000
	Total	18.0000	45.6667	+27.6667
Windsor Woods	Experimental	-------	-------	-------
	Control	19.0000	50.5000	+31.5000
	Total	19.0000	50.5000	+31.5000
TOTAL	Experimental	23.4545	49.0000	+25.5455
	Control	19.6000	44.4000	+24.8000
GRAND TOTAL		20.9677	46.0323	+25.0646

Table 18

Analysis of Covariance for Nonwhite First Grade Students on the California Achievement Test: Total Reading

Source of Variation	Sum of Squares	df	Mean Square	F	Significance of F
Covariate (Pretest)	720.978	1	720.978	8.174	0.008*
Main Effects (Group)	26.204	1	26.204	0.297	0.590
Residual	2,469.783	28	88.207		
Total	3,216.965	30	107.232		

*Significant at $p < .05$

for the covariate (pretest), a statistically significant difference was not observed for the main effect (difference between groups). Therefore, no statistically significant difference exists between the achievement of the experimental group (small classes) of nonwhite first graders and the achievement of the control group (large classes) of nonwhite first graders as measured by the total reading California Achievement Test.

CHAPTER 4

SUMMARY AND CONCLUSIONS

Chapter 4

SUMMARY AND CONCLUSIONS

This final section is devoted to a summarization of what the study set out to accomplish and to provide definitive conclusions based upon the findings of the study.

SUMMARY

Researchers have long concerned themselves with the effect of class size on pupil achievement. Educators and lay persons have debated the possible impact of reductions in class size. Increased learning which might result from more individualized instruction has been an area of considerable contention. Investigators have designed and executed a considerable number and a wide variety of studies to arrive at some definitive conclusion about how pupil achievement is affected by smaller classes. There is little agreement among the investigators about what the actual effects are. When one reviews previous studies, one recognizes that it is difficult, if not impossible, to design a study which will produce results that can be generalized to every population and circumstance. Because data from previous class size studies can not be generalized, it is reasonable that one consider each study in terms of a specific population, design, and intent.

The Virginia Beach City Public Schools Class Size Project was a research and development effort growing out of a directive by the School Board to determine the effects of class size on the reading achievement

of pupils in the lower elementary grades. Specifically, the study determined the effect class size had on the reading achievement of first grade students.

In this research study, a class of twenty-nine pupils, referred to as the large ("normal" or control) class, constituted one treatment group; and a class of twenty-one students, referred to as the small ("reduced" or experimental) class, constituted the other treatment group. During the study, student/teacher ratios remained below the maximum number of thirty students in Average Daily Membership for the teachers involved in the study. Such ratios were in compliance with the Standards of Quality and Objectives for Public Schools in Virginia enacted by the General Assembly and with ratios mandated by the Southern Association of Colleges and Schools.

After the first grade classes had been randomly assigned in each project school, the Ad Hoc Committee randomly selected and assigned one first grade teacher from each school to each treatment group. Teachers involved in the study followed the usual curriculum and instructional procedures to teach their assigned project classes.

The Virginia Beach City Public Schools Class Size Project, which began September 1980, was designed to provide reliable data about class size impact on reading achievement. Therefore, systematic implementation and evaluation of the class size program in the pilot schools should provide reliable data on which to make decisions of whether the model should be extended to other schools, modified and continued for purposes of further study, or terminated.

California Achievement Tests

To obtain the reading achievement test raw scores, students were administered a pre/posttest edition of the California Achievement Tests, Level 11C (CAT). The basic purpose of the CAT is to measure knowledge and understanding in reading, mathematics, language, spelling, and reference skills; however, for this study, only the reading achievement battery was administered. Reading achievement test results were compared for the total reading test.

All First Grade Students

The purpose of this phase was to compare reading achievement test scores of first grade students who participated in the experimental classes (small classes, maximum of twenty-one students per class), with the reading achievement test scores of first grade students who participated in the control classes (large classes, maximum of twenty-nine students per class). Usable reading achievement test scores were obtained from three hundred thirty-five first graders--one hundred forty-one students in the experimental group and one hundred ninety-four students in the control group.

The analysis of covariance (ANOCOVA) procedure, performed on the reading achievement test of the CAT, produced a statistically significant difference ($p < .05$) between the test scores of the treatment groups. For the reading achievement test, the experimental group exhibited a higher test score mean.

Male First Grade Students

The purpose of this phase was to compare reading achievement test scores of male first grade students who participated in the experimental classes (small classes, maximum of twenty-one students per class), with the reading achievement test scores of male first grade students who participated in the control classes (large classes, maximum of twenty-nine students per class). Usable reading achievement test scores were obtained from one hundred seventy first graders--seventy-one male students in the experimental group and ninety-nine male students in the control group.

The analysis of covariance (ANOCOVA) procedure, performed on the reading achievement test of the CAT, produced a statistically significant difference ($p < .05$) between the test scores of the treatment groups. For the reading achievement test, the experimental group exhibited a higher test score mean.

Female First Grade Students

The purpose of this phase was to compare reading achievement test scores of female first grade students who participated in the experimental classes (small classes, maximum of twenty-one students per class), with the reading achievement test scores of female first grade students who participated in the control classes (large classes, maximum of twenty-nine students per class). Usable reading achievement test scores were obtained from one hundred sixty-five first graders--seventy female students in the experimental group and ninety-five female students in the control group.

The analysis of covariance (ANOCOVA) procedure, performed on the reading achievement test of the CAT, produced a statistically significant difference ($p < .05$) between the test scores of the treatment groups. For the reading achievement test, the experimental group exhibited a higher test score mean.

White First Grade Students

The purpose of this phase was to compare reading achievement test scores of white first grade students who participated in the experimental classes (small classes, maximum of twenty-one students per class), with the reading achievement test scores of white first grade students who participated in the control classes (large classes, maximum of twenty-nine students per class). Usable reading achievement test scores were obtained from three hundred three first graders--one hundred thirty white students in the experimental group and one hundred seventy-three white students in the control group.

The analysis of covariance (ANOCOVA) procedure, performed on the reading achievement test of the CAT, produced a statistically significant difference ($p < .05$) between the test scores. For the reading achievement test, the experimental group exhibited a higher test score mean.

Nonwhite First Grade Students

The purpose of this phase was to compare reading achievement test scores of nonwhite first grade students who participated in the experimental class (small classes, maximum of twenty-one students per class), with the reading achievement test scores of nonwhite first grade students who participated in the control classes (large classes, maximum

of twenty-nine students per class). Usable reading achievement test scores were obtained from thirty-two first graders--eleven nonwhite students in the experimental group and twenty-one nonwhite students in the control group.

The analysis of covariance (ANOCOVA) procedure, performed on the reading achievement test of the CAT, did not produce a statistically significant difference ($p < .05$) between the test scores. (NOTE: Because the analysis was based upon such a small sample, extreme caution should be emphasized in generalizing the findings to the total nonwhite first grade student population.)

CONCLUSIONS

The findings of this study were such that the following conclusions were drawn:

1. The reading achievement of first grade students in smaller classes (based upon student/teacher ratio), when compared to the reading achievement of first grade students in larger classes, was significantly higher.

2. The reading achievement of male first grade students in smaller classes, when compared to the reading achievement of male first grade students in larger classes, was significantly higher.

3. The reading achievement of female first grade students in smaller classes, when compared to the reading achievement of female first grade students in larger classes, was significantly higher.

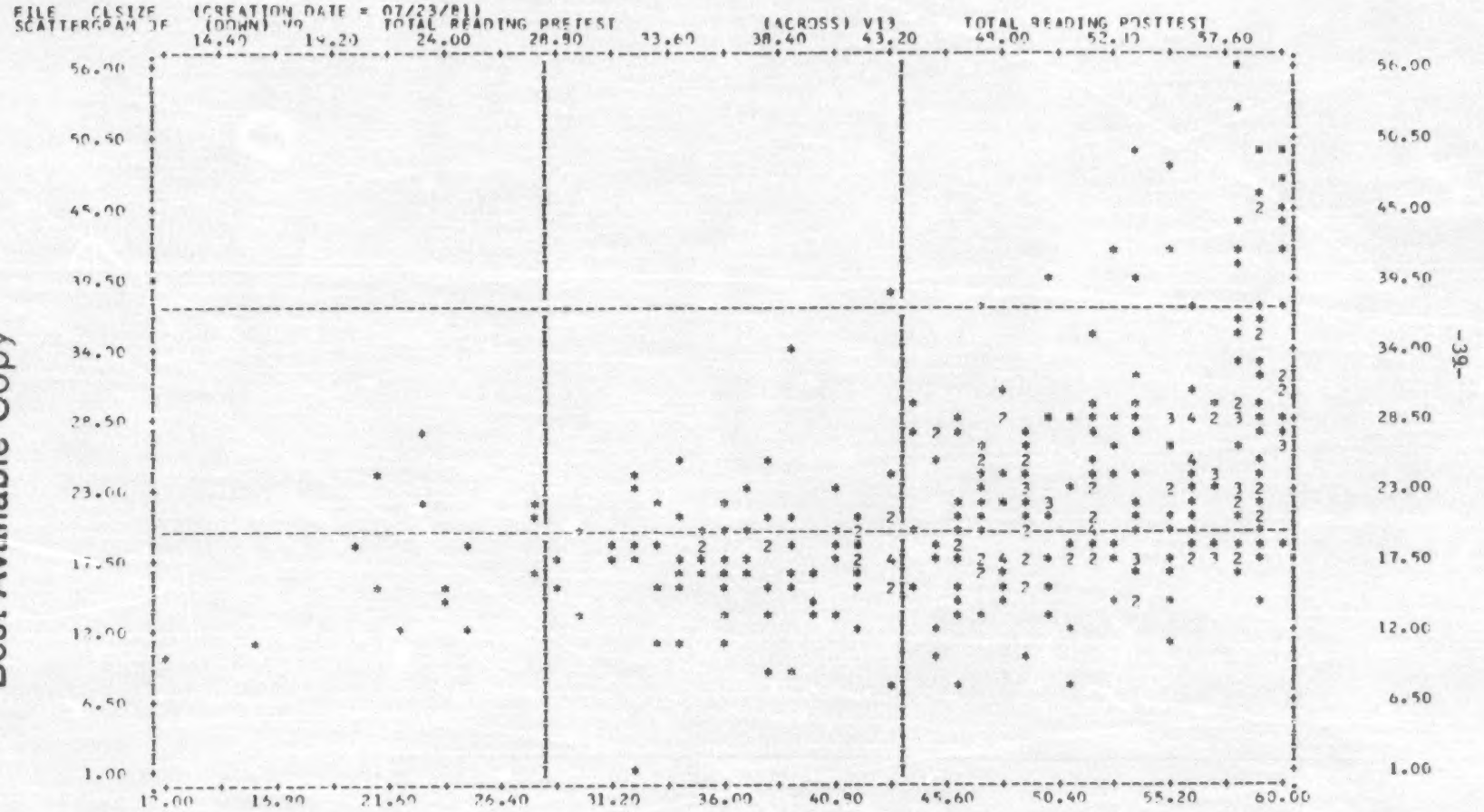
4. The reading achievement of white first grade students in smaller classes, when compared to the reading achievement of white first grade students in larger classes, was significantly higher.

5. The reading achievement of the nonwhite first grade students in smaller classes, when compared to the reading achievement of nonwhite first grade students in larger classes, was not significantly different.

APPENDIX

FIGURE 1

Scattergram of All First Grade Students' Raw Scores
on the
California Achievement Test: Total Reading



STATISTICS..

CORRELATION (R)-	0.47978	R SQUARED -	0.23019	SIGNIFICANCE -	0.00000
STD ERR OF EST -	7.44682	INTERCEPT (A) -	2.89305	SLOPE (B) -	0.41092
PLOTTED VALUES -	322	EXCLUDED VALUES-	0	MISSING VALUES -	13

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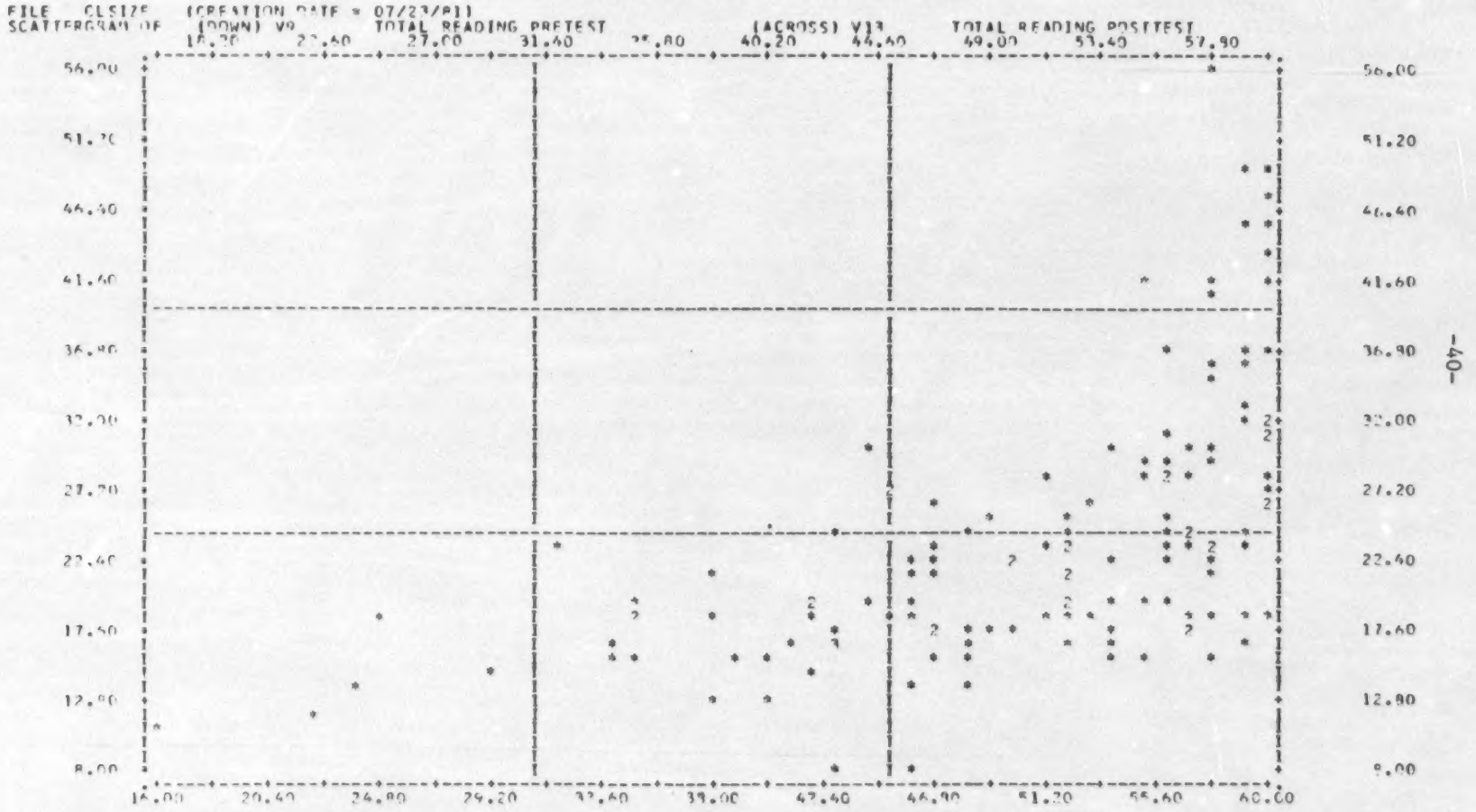
FIGURE 2

Scattergram of All Experimental Group First Grade Students' Raw Scores
on the
California Achievement Test: Total Reading



STATISTICS..

CORRELATION (R)-	0.56955	R SQUARED -	0.32325	SIGNIFICANCE -	0.00000
STD ERR OF EST -	7.20519	INTERCEPT (A) -	-3.91463	SLOPE (B) -	0.54896
PLOTTED VALUES -	139	EXCLUDED VALUES-	0	MISSING VALUES -	2

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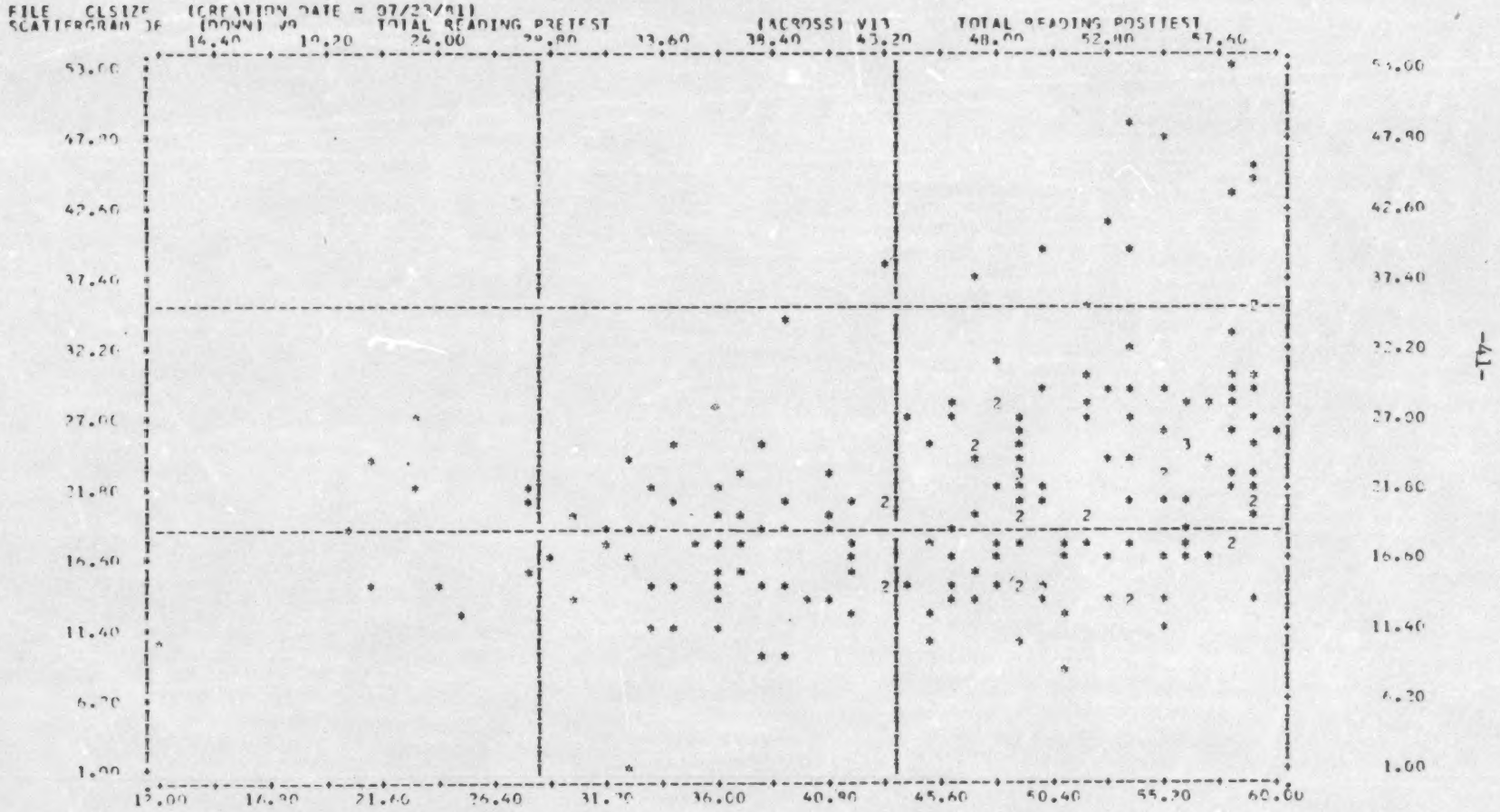
FIGURE 3

Scattergram of All Control Group First Grade Students' Raw Scores
on the
California Achievement Test: Total Reading



STATISTICS..

CORRELATION (R) -	0.39781	R SQUARED -	0.15829	SIGNIFICANCE -	0.00000
STD ERR OF EST -	7.52456	INTERCEPT (A) -	6.99272	SLOPE (B) -	0.32041
PLOTTED VALUES -	193	EXCLUDED VALUES-	0	MISSING VALUES -	11

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